

THESIS FOR DEGREE OF M.D. 1923

SUBJECT - TYPHOID CARRIERS IN ABERDEENSHIRE.

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INTRODUCTORY.

The discovery of the human carrier as an agent in the spread of infectious disease opened a new era in the study of epidemiology. The conception of the carrier condition as a means whereby disease was spread had occurred to Koch in the course of his investigations into the outbreak of Cholera in Germany in 1891-92. In an Address delivered in November of 1902 he enunciated the view that the chief source of infection in Typhoid Fever was the Typhoid patient or the Typhoid convalescent who happened to harbour the specific germs. The work carried out in the bacteriological stations, which, by Koch's advice, the Government established in South-West Germany where Typhoid Fever had assumed serious proportions, furnished proofs of the correctness of this view, and by the end of 1907, 421 Typhoid carriers had been identified, of whom 211 were transitory and 220 chronic.

The first carrier to be identified outside Germany as the cause of an outbreak of Typhoid was the cook in New York who came to be known as "Typhoid Mary". In the beginning of 1907, two cases occurred in the house in which this woman was employed as a servant, and it was found that 22 cases of Typhoid had/

had occurred in six other families in whose service she had been between the years 1900-07. She was forcibly removed to Hospital by the Authorities and found to be a faecal carrier. She was detained in Hospital for three years and then discharged, Dr. Park¹ says, after a promise given that she would not engage in cooking. In 1915, however, according to Professor Simon,² she re-appeared under an assumed name as the cause of an outbreak of Typhoid Fever in the Sloan Hospital for Women in New York. She had been engaged as cook to that Institution in October of 1914, and in January and February of 1915, 25 cases of Typhoid occurred among the staff and the inmates. She was again isolated, and closer investigation into her history showed that besides the 24 cases previously found associated with her she had infected others, and further that she was possibly the cause of a water-borne outbreak in Ithaca, N.Y. State, in 1903, in which 1,300 cases occurred. It would be difficult to find a more striking illustration of the danger of Typhoid carriers and the difficulty of dealing with them when found so long as no cure is available for the condition.

The outbreak of Typhoid Fever at the Brentry Reformatory, Bristol, which lasted from September 1906 to November 1907 (28 cases) was the first in England in which a carrier was identified as the cause. The outbreak was investigated by Dr. Davies/

Davies,³ Medical Officer of Health for Bristol, and Dr. Branthwaite for the Home Office. After a prolonged inquiry, suspicion fell upon a woman who was employed as cook and dairymaid, and the examination of her stools carried out by Professor Walker Hall, Bristol University College, showed her to be a faecal carrier. It was found that she had been connected previously with outbreaks in other two Institutions. A Report on this outbreak was presented to Parliament by Dr. Branthwaite⁴ in 1908. The Report details in full the investigations into all the various matters such as drainage, etc., which up to that time had been believed to be associated with the causation of Typhoid Fever, and which had been gone into very thoroughly before the idea of a carrier as the possible cause of the outbreak had occurred to the investigators. Dr. Branthwaite appends a bibliography consisting of ten Papers on Typhoid carriers published in the years 1906-08, seven by German workers (1906-07), one by an American (1907), and two by English workers (1908).

Since then the part played by the chronic Typhoid carrier in perpetuating the disease has been amply demonstrated. It is through the existence of these carriers that the disease remains endemic.

A rural area affords special facilities for the discovery of Typhoid carriers owing to the fact that outbreaks tend to recur at the place/

place where the carrier is, and that the movements of carriers and patients and their contact with others can be readily determined, while the number of persons among whom the carrier has to be searched for is comparatively limited. The chief difficulty lies in obtaining the samples of stools and urine necessary for identification of the Typhoid state. As there have been no compulsory powers, and it is not clear if there are yet any to enable one to get these samples where refused, they could be obtained only by favour.

In 1908, I identified four chronic Typhoid carriers in connection with outbreaks, and since then I have found eighteen more, two in 1910, three in 1911, one in 1916, one in 1917, five in 1918, and six in 1919, making a total of twenty-two in all. Some of these as their histories will show had been associated with numerous outbreaks. Five were men and seventeen were women, giving a proportion of 77.3% of female carriers. In the German Stations up to the close of 1907, 82% of the chronic carriers found were women. The above proportion therefore approximates closely to the German figures. The carriers belonged to all classes of society. All were faecal carriers, one being a urinary carrier as well. In all my cases attention was directed to the carriers owing to a case or cases of actual Typhoid Fever occurring, and accordingly this experience indicates that, as is generally believed, faecal carriers are altogether in excess of urinary/

urinary carriers, or that urinary carriers may not have the special malignancy commonly attributed to them.

The treatment of Typhoid carriers has so far been very disappointing. With regard to faecal carriers, Ledingham & Arkwright⁵ conclude their review of the various lines of treatment with the remark, "We have to deplore the fact that so far the attempts to cure intestinal carriers have not yielded results affording convincing evidence of their success..... In the case of carriers who are in an early stage of this condition, there may be some hope of effecting a permanent cure by one or other of the methods already tried and quoted above, but in long-standing chronic cases, the prospect of success of this kind would seem to be extremely remote!" With regard to urinary carriers, they give the history of four carriers apparently cured. One of the cases was treated by Irwin & Houston with Vaccine, the dosage beginning with 50 millions and rising to 1,000 millions, while another case treated by Walker Hall & Roberts had first a course of Vaccine, then an operation on one of the kidneys with the removal of several aggregations of minute calculi, followed by a second course of Vaccine rising to 6,000 millions. Thomson & Ledingham treated five female faecal carriers with Vaccine without result, and in another case described in the Report of the Director-General of the Army Medical Service for 1909, Vaccine treatment was combined with X-ray/

X-ray treatment applied in the region of the Gall-Bladder, but without success.

"The cure of chronic carriers," says Surgeon-Commander S.F. Dudley,⁶ "seems almost hopeless. As Sir William Andrews pointed out to this Society, this is not surprising; they are immune!"

In 1921, with the co-operation of Dr. Thomson, Director of the Pickett-Thomson Research Laboratory, St. Paul's Hospital, London, who very kindly undertook to supply a detoxicated autogenous Vaccine, I arranged for the treatment of a chronic faecal carrier with Vaccine. This was begun in December 1921 and has been carried on up to the date of writing (February 1923) with what seems a hopeful result. The carrier-a lady- had an attack of Typhoid Fever in 1903 and was the cause of five outbreaks between the years 1904-17. I found her to be a carrier in 1910. She is No.6 of the series (page 26)). The treatment was by subcutaneous injections. The dosage began with 1,000 million bacilli and was raised gradually to 30,000 millions. A second course was given after a short interval. This was carried up to 23,000 millions and was accompanied by the oral administration of Vaccine given with ox-bile pills, two grains in each. I have embodied the details of the case in this Paper.

As bearing on the question of the Vaccine treatment of carriers, I have added an account of three chronic nasal Diphtheria carriers which were treated in 1920 in/

in one of our Hospitals with detoxicated Vaccine also supplied by Dr. Thomson, one of these carriers being of five years standing, another of two and a half, and a third of one and a half years. These are the only cases of chronic nasal Diphtheria carriers of over six months standing of whom a cure has been recorded.

In this Paper I propose first, to give an account of the twenty-two Typhoid carriers I have found in the order in which they were met with; second, to detail the treatment of the Typhoid and Diphtheria carriers above referred to with the results; and lastly, to make some observations on the present position of the Law in Scotland as regards Typhoid carriers. Detailed information of cases of Typhoid carriers collected over a long period of observation is so scanty in the literature of the subject as to warrant the following Report of the carriers I have found; while the importance of the information obtained in the investigations seems ground for them being submitted as the main substance of the Thesis.

TYPHOID CARRIERS.

Year, 1908.

CASE 1.

Mrs W. Wife of tenant of Farm F.

The following outbreaks of Typhoid Fever had occurred at this Farm:-

1892	Nov. 2nd.	Daughter	13 months.
	" "	Husband	28 years.
	" "	Daughter	3 "
	" 14th.	Farm Servant	35 "
1897	Oct. 3rd.	" "	- (Died)
1906	Nov. 6th.	Daughter	9 months.
1908	Aug. 7th.	Farm Servant	27 years.
	" "	" "	15 "
	" 8th.	Domestic Servant	17 "
	" 16th.	Daughter	-

Between 1892 and 1906, there had been cases of illness in the family which the medical attendant, in the light of subsequent events, was inclined to look back upon with suspicion as having been probably Typhoid, although he had not at the time diagnosed them as such. Only two children out of a large family would seem to have escaped an attack.

In 1908, a sister-in-law of Mrs W, who had been/

been staying with her family of four daughters for summer holidays in a village near, developed Typhoid after her return home, as did also two of the daughters. They had received part of their milk supply from the Farm of F. I found however, subsequently that the woman in whose house they were lodging, and from whom they got part of their milk, was also a Typhoid carrier so that infection might have come from either source.

An examination of stools which I obtained in connection with the outbreak at the farm in 1908 showed Mrs W to be a faecal carrier. The examination was carried out in the Pathology Department of Aberdeen University. Mrs W had an attack of Typhoid in 1890, shortly before her marriage. Her husband entered the Farm of F in 1892, and no outbreak of Typhoid was known to have occurred there before that date. Precautions with regard to the handling of food were enjoined, but in 1911 another case of Typhoid occurred at F, a man-servant, age 19, and in the same year a girl of 19 working at a neighbouring farm which got milk from F developed Typhoid. In 1914, a case occurred in a neighbouring village, a young man of 20 who had been working at F and came home from there ill. No cases have since occurred at F or been connected with the Farm.

I may mention that a new water supply had been introduced and a new house built prior to 1906/

1906.

CASE 2. The second case identified in 1908 was a woman A.P., age 63, who was acting at the time as house-keeper to a Farmer, Mr. S. The latter was about to be married when he developed Typhoid, was removed to Hospital on 31st August, and died on the 16th September 1908. A.P. was known to have been working in houses in the County where previous outbreaks had occurred, and suspecting her to be a carrier, I persuaded her to go to Hospital where samples of her stools and urine were taken and sent to the Pathological Department of Aberdeen University. The stools proved to be positive.

A.P. had passed through a severe attack of Typhoid in 1900 while a patient in Banff Asylum. This Asylum, as related by Ledingham & Arkwright, had, between the years 1893 and 1907, been visited by eleven outbreaks of Typhoid with a total of 31 cases. In 1907, a systematic search for carriers was undertaken by Drs A. and J.G.C. Ledingham, and three carriers were discovered among the female patients. These were isolated, after which the outbreaks ceased.

Shortly after her attack of Typhoid, in the end of 1900, A.P. was discharged from the Asylum and went to reside for a time at a Farm B in the vicinity, in the Parish of Kirkmichael. Here, occurred the first outbreak with which she was connected. I ascertained through an enquiry/

enquiry kindly made for me by Dr. Ledingham, Medical Officer of Health for the County, that during her stay at B she assisted occasionally in the work of the kitchen and took the kitchen servant's place when the latter, who was the first known case, became ill. This outbreak produced 13 cases. The following account of it is taken from the Report for 1901 of Dr. Cameron, then Medical Officer of Health for the County:-

"The most serious outbreak occurred in the Kirkmichael, Tomintoul and Glenlivet Districts. A servant girl was taken ill at a farm in Kirkmichael in April, and the medical attendant told me he suspected Typhoid Fever; also that he understood there were other suspicious cases there not under his care. The patient was removed to Glenlivet and duly certified. The medical attendant himself contracted the disease. Between hearing of the case and receiving the certificate, a case of Typhoid Fever was notified from Tomintoul village. On enquiring into the matter, I found that the latter patient also had been in service at the farm above referred to and returned ill to Tomintoul. I also learned from his medical attendant that there was a case of Typhoid Fever at the farm which he was about to notify. On visiting the farm, I ascertained that the children/

children (three) had been taken ill in March with what was supposed to be Measles, and that the Farmer himself was just convalescent from an attack of bilious fever. I suspected that the Farmer and his children had been suffering from Typhoid Fever, and my suspicions were afterwards confirmed by a bacteriological examination. Another case occurred at the farm shortly afterwards, and two brothers of the Tomintoul patient contracted the disease. These three cases were removed to Hospital, the last on the first of June. On the 9th of July, I received intimation of two other cases of Typhoid in the village of Tomintoul in the cottage (semi-detached) adjacent to that in which the previous cases occurred. On visiting the following day, I found other members of the family were ill. They could not be removed to Hospital owing to lack of accommodation. Arrangements were made locally. The disease was confined to the family. All the cases recovered."

A.P. came soon after to Aberdeenshire and at the following places outbreaks of Typhoid occurred while she was occupying the position of cook or cook-housekeeper:-

1. Oct. 1901 Hotel, village of R - Four cases directly connected with the Hotel.
 - (a) Maid Servant, aet.15, notified 21st October.

(b)/

- (b) Daughter of the Proprietrix,
aet.7, notified 21st October.
- (c) Merchant's wife in village,
aet.25, notified 13th November,
getting milk from Hotel up to
29th October.
- (d) The Proprietrix herself,
notified 18th December.

Other five cases of Typhoid occurred in the village about this time, but had no known connection with the Hotel.

- 2. Apl. 1902 Farm of A in the District of H.
Three cases. The Farmer, Mr.G,
his wife and daughter. All
notified on 5th April.
- 3. Jan. 1905 Farm of O. Two cases.
The Farmer, aet.50, and his son,
aet.16. Notified 28th January.
- 4. Aug-Sept. 1907 Farm of F. Four cases.
Aug. 31st. Farm Servant, aet.16.
" " " " " 25
Sept. 5th. The Farmer himself, aet.40.
" 29th. A daughter of the Farmer, aet.4.
- 5. Sept. 1908. Farm of S where as mentioned the
Farmer, Mr. S took Typhoid and died.

In 1903, while A.P. was in the service of the manager of the G. Distillery in the District of H, he and his daughter each passed through a severe illness which, in the light of subsequent events, was most probably Typhoid though not diagnosed as such at the time.

It will thus be seen that exclusive of the two suspicious/

suspicious cases in 1903, A.P. was responsible for 28 cases of Typhoid occurring in six outbreaks.

On my recommendation, the Local Authority of the Garioch District in which Farm S was situated resolved, in view of A.P.'s history and the fact that she had no means of livelihood if precluded from following her usual occupation, to offer her the equivalent of the Old Age Pension, (she was then about 63), on condition that she engaged in no work that involved the handling of food. To this the Local Government Board gave their sanction. A.P. accepted the offer, and went to live in the Burgh of H where she resided alone for two years. I endeavoured, unfortunately without success, to obtain for her work of a kind that she could do without risk to others. As she had been accustomed to an active life, time hung heavy on her hands. Wearying after two years of having nothing to do, she decided to give up her allowance and go back to work. She got an engagement in the neighbourhood. Hearing of this, I obtained her consent to warn her employer, but he persisted in keeping her in his service. She was there, however, only a few weeks when she again became insane and was removed to Banff Asylum. There, the examination of her stools showed them to be still positive.

She recovered within a year and was discharged on the 6th of March 1911. I obtained the sanction of the Committee to offer her her allowance again/

again, but she refused it and fell back upon parochial relief. On the 12th of November 1913, a case of Typhoid was notified to me from the Farm of B, three miles from the Burgh of H where she was living. On enquiry, I found that A.P. had been temporarily engaged to help in the kitchen work. The patient, a farm servant, aet. 21, had a very severe attack with haemorrhage, but recovered.

A.P. continued to live in the Burgh of H in receipt of parochial relief till November of 1918, when she died of acute bronchitis and asthma complicated with heart disease. To the end she remained convinced that she was not a Typhoid carrier, and that she was the unfortunate victim of official interference which she very bitterly resented.

I may mention that this case is quoted (page 35) by Ledingham & Arkwright to whom I supplied the data there given.

CASE 3. Miss S. aet. 53. Sister of a Farmer occupying the Farm of T.

An outbreak of Typhoid at this Farm in the Autumn of 1908 led to Miss S being identified as a carrier. Her history I found to be as follows:- Thirty-one years before in 1877, she had an attack of Typhoid Fever. She was then 22 years of age and was living/

living with her grandfather, Mr. R. a Dairy Farmer, occupying the Farm of G, a few miles from Aberdeen, and was assisting her grandmother in keeping house. Her grandmother died soon after and she kept house for her grandfather up to his death in 1889, and then for her brother who succeeded his grandfather in the Farm and carried on the dairying business till 1899. In that year Miss S and her brother removed to the Farm of W.M. in Kincardineshire where they stayed till 1907 when they again removed this time to the Farm of T, in Aberdeenshire. During the thirty-one years from 1877 to 1908, 24 cases of Typhoid occurred among the servants, while Miss S' brother and a nephew working on the Farm of G had also been attacked, making in all 26 cases.

The following Table gives a list of these cases with dates. The details were furnished to me by Miss S and her brother and confirmed after 1893 from official sources. I may mention that Mr. R occupied for two years, 1888-89, a Farm N adjoining G which belonged to him, but no cases occurred there.

FARM OF G. 1877 - 1899.

R.I: Royal Infirmary: C.H: City Hospital:
D.H. District Hospital.

Miss S' attack was in July of 1877.

- 1 1877 Sept. Servant girl.
- 2 " " Miss S's brother.
- 3 " Nov. Grieve on Farm. Very severe attack.
- 4 1878 July Servant girl. Mild case.
- 5 " Aug. Farm Servant. Removed to R.I. Mild case.
- 6 1882 Spring Servant lad. " " " Very severe.
- 7 1883 Summer Cousin, young lad, (21) working on Farm. Very severe.
- 8 1885 " Kitchen maid, aet.20. Mild.
- 9 " " Milk boy, aet.15. Removed to R.I. Severe.
- 10 " " Man Servant, aet.22. " " " "
- 1893 - Two severe cases of "Influenza" in this year, one of them fatal after a short illness, were probably cases of Typhoid. Other cases of "Influenza" according to Miss S occurred at G between the years 1892 and 1897 and were also possibly Typhoid.
- 11 1897 Aug.9th Farm Servant. Removed to R.I. Very severe.
- 12 " " 11th " " " " "
- 13 1898 July 21st " " aet.16, " " " Died.
- 14 " Nov.18th Domestic Servant. Went home ill to her mother's house in Aberdeen. Found to be suffering from Typhoid. Removed to R.I. Died.
- 15 " Dec.2nd. Farm Servant. Removed to R.I.

FARM OF W.M. KINCARDINESHIRE. 1900 - 1907.

- 16 1900 Aug.26th. Farm Servant aet.23. Too ill for removal. Treated in farm house. Died.
- 17 1901 Jan.29th. " " aet.22. Removed to C.H.

18	1901	Mar.16th.	Farm Servant.	Removed to C.H.
19	1902	Sept.6th.	" " aet.20,	" " "
		(This month, September 1902, two near neighbours, I.N. and Mrs G had very severe attacks of Typhoid).		
20	1903	Sept.11th.	Female Servant, aet.22.	Removed to County Hospital.
21	1904	Jan. 25th.	Farm Servant, aet.18,	"
22		Mar. 16th	Female Servant,"	" "
23	1905	Sept. 5th.	Farm Servant, - -	Removed to R.I. as suffering from Pneumonia. Found to be Typhoid and removed to C.H.

FARM OF T. 1907 - 1908.

24	1908	July 24th.	Domestic Servant.	Removed to D.H.	Died.
25	"	Aug.28th.	Farm Servant. aet.46,	" " "	
26	"	Oct.13th.	" " " 40.	" " "	

The most serious outbreak of Typhoid Fever with which Miss S was associated was one in Aberdeen which commenced in November of 1898 and continued into January of 1899 in which 26 cases occurred. The outbreak was traced to a dairy (R in W.G. Street) which received part of its supply from G. The milk supply from G was stopped. Suspicion had been directed to this part of R's supply through the fact that a domestic servant at G who had gone home ill to her mother's house in Aberdeen was there found to be suffering from Typhoid Fever. (Case 14 in Table). The beginning of this outbreak is thus described by Dr. Hay in his Report for November 1898. "At the moment of writing, a third milk epidemic of Typhoid appears/

appears to be commencing. To-day (Thursday) three cases occurring in three quite separate families in different parts of the town and in no way associated with the other outbreaks, have been reported, and they all have the same milk supply. These cases, taken along with other two reported early in the week which also had been obtaining a part of their milk from the same dairy, make it only too probable that the milk of this dairy also is infected. Enquiry was at once made into the source of the infection, but this is attended with much more difficulty than in the preceding outbreaks, owing to the dairyman, who has a business of considerable extent, deriving his supplies from a large number of farmers. We have, however, we believe, succeeded in tracing it to a farm in the Newhills District outside the City boundary from which a case of illness which was found to be Typhoid, and which has indeed terminated fatally, was removed to the Royal Infirmary during the present month. We hope to be able to arrange with the help of the County Authorities for the immediate stoppage of this milk supply to any part of the City until these Authorities are satisfied that the risk of the infection of the milk has entirely ceased. Meanwhile, a dairyman in the City, who has been obtaining a portion of his milk supply from this source has undertaken to stop it forthwith. Owing, however, to the lengthened period of incubation of Typhoid Fever, it is likely that several cases, perhaps numerous cases/

cases, from this source will continue to develop themselves during the next two or three weeks!" As mentioned above, 26 cases in all occurred before the outbreak stopped.

With Dr. Hay's permission, I made an examination of the City notification Registers and found that from 1891 to 1898, inclusive of the 26 cases in this outbreak, a total of 41 cases of Typhoid had been notified among the customers of R's dairy in W.G. Street, and Miss S informed me that during all these years this dairy received milk from them. When they went to Kincardineshire Miss S ceased to supply milk to R, but sent milk for two years to a dairy W in Aberdeen. I found in the Registers, 15 cases of Typhoid mentioned in these two years as receiving milk from this dairy, while for the next seven years, 1902-1908, only six cases were mentioned as occurring among customers. This, of course, might have been merely a coincidence, but in view of the number of cases that were connected with R's dairy from 1891 to 1898, it was suspicious.

It seems probable from the information I was able to gather that there were earlier outbreaks of Typhoid in Aberdeen associated with milk from G. Miss S and her brother told me that in 1885, Professor Simpson, at that time Medical Officer of Health for the City, visited the Farm in connection with Typhoid, and that the water supply which was derived from a pump near to/

to the midden but on higher ground, was analysed and found satisfactory. It will be seen from the Table that in that year two cases of Typhoid occurred at G and were removed to the Royal Infirmary, and there may have been cases in Aberdeen associated with these. In a letter to me, Professor Simpson, in reply to an enquiry, says:- "The name G Newhills is familiar to me, and I am almost sure that one of the outbreaks was traceable to this Farm." The late Mr. Reid, Sanitary Inspector for the Aberdeen District, told me that he remembered accompanying Professor Simpson on more than one occasion to G after he joined the City staff in 1883 in connection with Typhoid Fever in the City. The first time the Farm of G was visited in connection with Typhoid was in 1878 when Dr. Burr and Dr. Blaikie Smith were sent there by the Parish Council of Aberdeen to investigate because the Poorhouse received its milk supply from G, and the Governor had heard that there was an outbreak of Typhoid at the Farm (Cases 1-2-3 of the Table). The Report made was very unfavourable as regards the condition of the premises and Mr. R was warned though the milk supply to the Poorhouse was not taken away from him. I could not find however, from the Parish Council records of that date, any indication that cases of Typhoid had occurred among the inmates of the Poorhouse.

It may be mentioned that both at G. and W.M. every effort had been made to remove any insanitary condition/

condition, no less than £300 being spent at the latter place on water, drainage, and a new sleeping-place.

Miss S assured me that they left this Farm "just to get away from the Typhoid" and had gone to the Farm of T because cases of Typhoid had never been known to have occurred there.

On learning that she herself had been the source of all the outbreaks, Miss S was eager to know whether the condition could be cured. She decided finally to consult a surgeon in Aberdeen who found that she was suffering from Gall-Stones and recommended an operation. The operation was carried out and two large Gall-Stones removed. Miss S proved to be suffering from Tubercle, both of the Lungs and Abdomen, and survived the operation only a month.

Miss S was convinced that the source of her infection was the Farm of W, three or four miles distant from G, and that the infection was brought to G from this Farm by a maid-servant who came from W to G in 1877, and who had passed through an attack of Typhoid Fever at W. According to Miss S all the maids who went to W got Typhoid Fever, the cause being put down to a "bad drain". The tenant of W at that time was a Mr. D, and I have since ascertained that he and four members of his family suffered from Typhoid in 1862, the first to take it being a daughter who had been visiting a family in the vicinity where cases of Typhoid were. From this date to 1879 when Mr. D left the/

the Farm, outbreaks of Typhoid recurred at W, the maid-servants being chiefly attacked. It is significant that after Mr. D removed in 1879 to another Farm, an outbreak occurred at this Farm soon afterwards. Mr. D was married three times and cases occurred among the children of the third family, one of the daughters of this family having two attacks. The history clearly suggests that Mr. D had become a carrier from his attack in 1862 and was the source of the outbreaks at the Farm of W and so possibly indirectly of Miss S' attack.

CASE 4. Mrs B. aet.28. Wife of a Cottar at the Farm of T.

Three cases of Typhoid Fever occurred in her house and the house adjoining in August and September of 1908. The first case was that of a man lodging in the adjoining house who was notified on August 26th. A child of Mrs B was notified on September 14th, and her husband on September 24th. Mrs B had passed through an attack of Typhoid Fever before her marriage when she was a servant at the Farm of S where the series of cases occurred described on page 44. A sample of her stools and urine was sent to the Pathological Department of the University. The stools proved positive. With regard to the first of the three cases there was no evidence that the man had partaken of food in Mrs B's house. Both houses, however, were served by one privy, and the midden connected with it was undrained/

undrained and in a very filthy condition.

I lost sight of Mrs B subsequent to these cases till 1921. When investigating the cause of a case of Typhoid in the village of N.P. in that year, I found that she was living in the house adjoining that in which the case had occurred. She was now a widow, and had come to this house with her family a few months previously from Aberdeen where she had been resident for six years. The two houses were served by two privies which had a midden between them common to both privies, and the mother of the child with Typhoid had to cross this midden when cleaning out her privy. The midden was in a very filthy condition. I obtained a sample of stools and urine from Mrs B, but they were negative.

1910.

CASE 5. Mrs R. Wife of a Manufacturer, living at M.

There had been a number of outbreaks of Typhoid at M of which the following is a list subsequent to notification:-

1894	June 16th.	Domestic Servant.	aet. 20.	
	July 31st.	Boy, (Son of Employee)	" 8	(Died)
1896	Aug. 16th.	Domestic Servant	" 24	
	Sept. 1st.	Mrs S (Wife of Employee)	27	
	" 10th.	Domestic Servant of Mrs S	-	
1906	June 15th.	" "	of Mrs R	- (Died)
	Dec. 24th/			

1906 Dec. 24th. Employee, aet. 17.
1907 Feb. 14th. Mrs C - Sister of - aet. 24
last case who stayed with her.
" 19th. Sister of Mrs C. aet. 13
1908 July 20th. Man working temporarily at M.
aet. 29.
1910 Sept. 29th. Case in house adjacent, lad of
19, connection not very definite.

Mrs R had an attack of Typhoid in 1881.

At that time a sister who came to nurse her and a maid developed Typhoid, as did also a sister-in-law who lived next door and her maid. The local medical practitioner informed me in 1894 that "Mrs R's house for the last fifteen years has been periodically visited by Typhoid Fever"

Everything had been done at M in the way of sanitary improvements to try and stop the recurring out-breaks, but without avail. While investigating the case in 1910, I obtained samples of stools and urine from Mrs R whom I strongly suspected of being a carrier. Both stools and urine proved positive - the only case of a double carrier I have found.

Strict precautions were enjoined and observed, but in spite of these another case, that of a maid-servant, occurred in September of 1912. It was then decided to inoculate the maid-servants, and this has always been done since up to Mrs R's death which occurred within the past year. After this precaution was taken, no case occurred at M or was traceable to Mrs R up to her death.

CASE 6. Mrs M. Wife of Farmer (Retired professional man) occupying the Farm of C.

The following outbreaks have been associated with her:-

1904	Sept. 18th.	Domestic Servant	aet.22
	Nov. 29th.	Mrs M, a neighbour getting" milk from C.	35
1906	June 15th.	Farm Servant	" 18
1907	Dec. 27th.	" "	-
1910	June 14th.	" "	" 23
	Aug. 15th.	Domestic Servant	" 19
	Nov. 9th.	Mrs T, a neighbour, supplied with milk from C.	" 43
1917	June -	Domestic Servant	" 18

Mr. M himself had an illness in 1909 which was diagnosed as Influenza, but which might have been Typhoid. He was confined to bed for three weeks, and after a relapse for three weeks more, Insomnia being a marked feature of the illness.

Mrs M had passed through an attack of Typhoid in South Africa in 1903. The examination of the stools and urine in 1910 showed her to be a faecal carrier. Every precaution was taken but in 1917, a domestic servant, aet.18, developed Typhoid. This case presented certain interesting features. She was thought at first to be threatening an attack of Appendicitis and went home. Then she was sent by her own medical attendant/

attendant to the Royal Infirmary for operation. The examination made there suggested the possibility of Typhoid, and the blood was examined with positive result. She was accordingly removed to the City Hospital. The symptoms of Appendicitis, however, became more pronounced and she was operated on. She proved to be suffering from both diseases, but made a good recovery.

No cases have since occurred at C or been traceable to infection from Mrs M. A recent examination of her stools, however, showed that she was still a carrier. A positive result was not obtained till the sixth sample was examined.

CASE 7. Mrs R. Wife of Crofter and Labourer, carrying on a small Dairy business in the village of M.

The following list of cases were associated with her through the milk supply:-

1902	June 30th.	Male	aet. 43 years
1907	Mar. 19th.	Female	" 7 "
"	Apl. 9th.	Male	" 10 " (Died)
1908	Aug. 19th.	Female	-
1910	" 8th.	"	-
1911	June 7th.	Male	" 47 "
	" 7th.	"	" 14 "
	" 27th.	"	" 14 "

It was in connection with this last outbreak that I obtained samples of stools and urine from Mrs R who had passed through an attack of Typhoid earlier in her life. The examination of the stools showed her to be a faecal carrier. Mrs R undertook to give up all personal connection with the dairying work, and engaged a woman to milk and do everything in connection with the dairy. Her daughter later took this woman's place. The dairy is now closed.

CASE 8. Mrs W. Wife of Farmer, occupying the Farm of A.

In the latter part of 1911 and the beginning of 1912, the following cases of Typhoid were notified from this Farm:-

1911	Sept. 3rd.	Servant girl.	aet. 14 years.
	Dec. 2nd	Mrs S. (Monthly nurse attending on Mrs W)	" 45 "
	" 19th.	Domestic Servant	" 31 "
	" 21st.	Stepson of Mrs W.	" 9 "
1912	Jan. "	Farm Servant	" 17 "

I obtained samples of stools and urine from all the adults on the Farm. The stools of Mrs W proved positive. I did not obtain a history of her having had an attack of Typhoid, but there had been Typhoid Fever at the Farm occupied by her father when she was a girl, and it is possible that she may have/

have had a mild and unrecognised attack then.

In February of 1913 another case was notified from A, a domestic servant. Then a long interval elapsed without any further outbreak till 1921, when a domestic servant was removed to the District Hospital suffering from Typhoid. The case was a very mild one. I obtained two samples of stools and urine from Mrs W, but both were negative.

CASE 9. Mrs R. Wife of Labourer, in the village of S, associated with one case of Typhoid in 1905, and with another case in 1911.

A sample of stools examined in connection with the case in 1911 showed Mrs R to be a faecal carrier. No cases of Typhoid have since been traceable to or associated with her.

1916.

CASE 10. Mrs McR. aet.45. Widow. Acting as temporary cook to Miss W, tenant of the Farm of C.

In 1916, an outbreak of Typhoid Fever with five cases occurred at or in connection with this Farm. The first case was reported from Edinburgh, a girl of 14, who had been staying on holiday at a house near the Farm of/
of/

of C, the occupants of which got milk from C. This case was reported on September 25th, while Miss S, aet.61, the tenant of C, who had been ill for some time, was notified on September 27th. Mrs B, in whose house the case notified from Edinburgh had been living, took ill and was notified on September 30th. Two more cases occurred in October, one a lad of 17, son of Mrs B, and the other a niece of Miss W, aet.44, who had come to look after the house. Miss W was being treated at home. The following Table shows the cases with the dates of notification:-

Sept. 23rd.	Girl	aet. 14.	Edinburgh case.
" 27th.	Miss W	" 61	Occupant of Farm.
" 30th.	Mrs B	" 53	Neighbour getting milk.
Oct. 17th.	Son of Mrs B.	" 17	
" "	Miss W.	" 44	Niece of Miss W.

I succeeded in obtaining samples of stools and urine from the two domestic servants employed at C. The stools of the cook, Mrs McR, proved positive. She had no history of an attack of Typhoid and had never had any previous association with Typhoid though she had milked cows and had been engaged in work likely to spread infection. Her home was in Aberdeen, and she had been temporarily engaged as cook by Miss W. She returned to Aberdeen soon after. Dr. Hay, to whom I communicated the circumstances of the outbreak, persuaded her to go to the City Hospital for treatment. After six weeks stay there, her stools ceased to be positive, and she was discharged.

It/

It should be mentioned that while she was at C she assisted in milking the cows.

1917.

CASE 11. Mrs T. Widow. aet.65, living alone in the village of P, and doing such work as nursing, milking, etc.

In 1917, an outbreak of Typhoid occurred in the village of P with the following cases:-

June 19th.	Male	aet.10 years.		
" 28th.	Female	" 8	"	
" 30th.	"	" 35	"	
July 4th.	Male	" 6	"	
" 6th.	Female	" 69	"	
" 7th.	"	" 23	"	
" 14th.	"	" 37	"	
" 15th.	Male	" 7	"	
" 19th.	"	" 3	"	

The cases occurred in five households which got their milk from a croft where one cow was kept and the surplus milk sold. The milking was done by the sister of the tenant of the croft and by Mrs T. I obtained samples of stools and urine from both. There was no history of either having passed through an attack of Typhoid. The first two sets of samples were reported negative, but a third/

third set which, with some difficulty, I succeeded in obtaining showed Mrs T to be a faecal carrier. This result was subsequently confirmed by a number of examinations of her stools. As stated, she had no history of ever having passed through an attack of Typhoid or of ever before having any association with Typhoid. She had had an attack of Influenza in the winter of 1916-17, but the symptoms were very indefinite.

In November of this same year (1917), Mrs T went to keep house for a friend for a few days when the latter was away on holiday, and five weeks later a lodger in the house, a lad of 20, was removed to Hospital suffering from Typhoid.

As Mrs T had no adequate means of livelihood without doing work which involved the handling of food, the District Committee agreed, on my recommendation, to make her an allowance of 10/- a week on condition of her abstaining from any kind of work connected with food or with nursing. This she accepted, and drew the allowance till her death which took place in 1920.

1918.

CASE 12. Mr. R. Tenant of the Farm of B.

The following outbreaks have been associated/

associated with this Farm during the tenancy of Mr. R:-

1901 June 6th. Farm Servant. aet. 18 years.
(This case went home ill and infected several members of his family).

1915 - Son " 8 "

1916 - Farm Servant " 16 "

1917 Nov. 29th. " " " 42 "

Dec. 1st. " " -

1922 July - Domestic Servant " 15 "

In connection with the outbreaks in 1916 and 1917, I obtained samples of stools and urine from Mr. R, his wife and son. One set examined in 1916 and two sets of samples in 1917 were all reported negative. In 1918, although no other outbreak had occurred, I succeeded in obtaining further samples of stools and urine from Mr. R, his wife and son, as I was convinced that Mr. R was a carrier seeing that he was not married in 1901 when the first outbreak occurred and he alone therefore had been at the farm on the occasion of each outbreak. As I anticipated, the stools of Mr. R proved positive. Stringent precautions were enjoined and observed and no case occurred at B till 1922 when a maid-servant became ill, went to her home in Aberdeen where her illness was found to be Typhoid and she was removed to Hospital. She recovered after rather a prolonged attack. I failed to obtain samples of stools from Mr/

Mr. R in connection with this last case.

CASE 13. Mr. S. Crofter, occupying croft of B of A.

Mr. S worked in his spare time on farms in the neighbourhood, and it was observed that he had been working at three places at the time when cases of Typhoid had occurred. He was in this way associated with the following outbreaks:-

Farm of A. 1912. Four cases.

Aug. 9th.	Farm Servant	aet.30	years
Sept. 20th	Son of previous case	" 4	"
Oct. 18th	Farm Servant	" 16	"
" "	Domestic Servant	" 16	"

Farm of B. 1914. Five cases.

Oct. 27th.	Farm Servant	" 24	"
" 28th.	" "	" 29	"
" 31st.	Farmer	" 38	"
Nov. 26th.	Female Servant	" 27	"
" 30th.	" "	-	

Farm of C. 1917 One case.

Sept. 21st.	Female	" 50	"
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For this last case I could find no possible cause apart from the fact that Mr. S whom I knew to have had/

had an attack of Typhoid a number of years before, had been working at the place for some time and would have been there at the probable date of infection. I obtained two samples of his stools and urine and they were examined, one on the 12th and the other on the 24th of November 1917, but both were reported negative. I retained the conviction, however, that S was a carrier, and in September of 1918, though no fresh cases had been associated with him, I obtained further samples from him as also from his wife and daughter who also had had Typhoid Fever at the time of Mr. S's attack. The stools from Mr. S proved positive. No case has since been associated with him till the present year (1922) when a boy, a grand nephew, from Newcastle who had been on a visit to Mr. S developed Typhoid immediately after his return home. I asked for but did not obtain further samples of stools from Mr. S.

In illustration of this last case, it may be worth while giving the following history of a farm servant who was associated with four outbreaks of Typhoid at farms on which he was working when the outbreaks occurred, but who refused to give me samples of his stools and urine so that I could not definitely determine whether he was a carrier or not. His history certainly pointed very strongly to his being a carrier. It was as follows:-

This man (U) had an attack of Typhoid in

1892/

1892 and in 1900 two of his sons, in 1907, a daughter, (2½ years), and in 1909, another daughter (7 years), all had attacks of Typhoid Fever. U was working as a farm servant on the following farms when outbreaks occurred:-

Farm of A.

1905	Sept. 1st.	Daughter	aet.23	(Died)
	Dec. 31st.	Boy (Child of Cottar)	" 11	
	Jan. 21st.	Daughter	" 19	
	"	Son	-	
	" 27th.	Domestic Servant	-	

Farm of L.

1907	Jan. 29th	Farm Servant	aet.33	
	Feb. 7th.	Wife of last case	-	
	Apl. 15th.	Child of U (Cottar house)	2½	

Farm of A.

1909	May 15th.	Farm Servant	aet.20	
	July 24th.	" "	-	
	Aug. 14th	" "	-	

Farm of E.C.

1911	Sept.10th.	Farm Servant	aet.17	
	" 20th.	Son of Farmer	" 21	
	" "	Daughter of Farmer	" 15	

In connection with the outbreak at E.C.

in 1911, I used my utmost efforts to obtain samples of stools and urine from U, but his wife persuaded him not to grant my request.

CASE 14. Mr. L. aet. 67. Retired.

Mr. L had an ambulant attack of Typhoid in 1918. He was never confined to bed, but his blood and stools were positive. His wife had a severe attack at the same time which proved fatal. Mr. L's stools continued positive for a number of months and a course of Hexamine which was tried by his medical attendant was without result. The stools were still positive when the examinations were discontinued. No case of Typhoid however has been associated with him. This year (1922) in connection with an outbreak of what proved to be Para-Typhoid in a house near by, I took the occasion to have a series of samples of Mr. L's stools examined. All proved to be negative.

The infection to Mr. L and his wife came from a neighbouring farm through the milk which was the source of the epidemic in Aberdeen in 1918.

CASE 15. Mrs P. aet. 33, residing in the village of P.

Mrs P had an attack of Typhoid in 1917 along with two of her children. She was treated in Hospital and discharged only after several examinations of her stools and urine had shown them to be negative. In the following year another child of hers was notified on the 21st of September and another on the 7th of November as cases of Typhoid. There was a possible source of infection through the/

the milk from a case which had occurred at the dairy where Mrs P got her milk supply. In view, however, of Mrs P's attack in the previous year, I thought it well to have a sample of her stools and urine again examined. The stools proved positive. She had been connected with no case since nor has any further sample been examined.

CASE 16. A.B. aet. 45. Servant at a Dairy Farm.

A.B. had conducted the dairy operations at the Farm of F for a number of years. She had been connected with several cases. A servant girl at the Farm had an attack of Typhoid in November of 1896, while the tenant of the Farm, her first master, died of Typhoid in 1909. I endeavoured in 1908 to obtain samples of her stools and urine, but without success. In connection, however, with a case which occurred in 1918 among the customers of the Dairy, I succeeded in obtaining samples of her stools and urine as also from her master and mistress, both of whom had had Typhoid Fever. The first two sets of samples were reported negative, but a third set which I obtained and had examined showed that A.B. was a faecal carrier. She was immediately removed from all connection with the milk and every precaution taken. No case was subsequently connected with the Dairy which has since been closed.

1919.

CASE 17. Mrs B. Crofter's wife. aet.about 60.

CASE 18. Mr. R. Crofter. " " 75.

CASE 19. Mrs R. Wife of above. " " 70.

These three carriers were identified at the same time through an outbreak of Typhoid in 1919. Their two crofts were within half a mile of each other. The circumstances of this outbreak were as follows:- On May 22nd, two children, brother and sister, age $13\frac{1}{2}$ and 12, were notified from a house in the vicinity of these crofts as cases of Typhoid. Their mother had been for six weeks previously nursing a man who had been suffering from what had been diagnosed as an attack of Influenza. This man was a son-in-law of Mrs B and worked on her croft, but had a home of his own. I had long suspected Mrs B of being a carrier from outbreaks with which I knew her to have been associated and her history suggested that this illness of her son-in-law might really be Typhoid. I communicated my suspicion to his medical attendant who had a sample of blood taken and examined. The result of the Widal was positive. Before the contacts could be inoculated, a grand-daughter of Mrs B, a girl of 17, who was acting as a servant to her, was notified from her home, whither she had gone ill, as a case of Typhoid. In the course of the investigations/

investigations I found that the mother of the two children first notified obtained her milk from Mrs R. I knew that Mrs R also had been associated with two outbreaks of Typhoid, and as she and her husband had both had Typhoid as also had Mrs B, I asked for and obtained samples of stools and urine from them all. The examination showed all three to be faecal carriers. There were therefore two sources from which the children might have received infection, but it was most probably, I think, carried by their mother from Mrs B's son-in-law while she was engaged in nursing him.

I may add that the District of M in which these crofts were situated was, in former years, noted for its Typhoid incidence.

The following are the outbreaks with which Mrs B and Mrs R had been directly connected:-

Mrs B.

1893	March 17th.	F.	aet.13.	Milk from Mrs B.				
	May 26th.	M.	" 29	" "	" "	" "	" "	" "
1897	July 19th.	M.	-	" "	" "	" "	" "	" "
1898	Sept. 3rd.	M.	adult.	" "	" "	" "	" "	" "
1901	May 15th.	F.	"	" "	" "	" "	" "	" "
	July 19th.	M.	"	" "	" "	" "	" "	" "

Mrs R.

1893	June 24th.	M.	aet.52.	Milk from Mrs R.				
				(neighbouring house)				

"/

1893	June 24th.	F.	aet.10.	Milk from Mrs R. (neighbouring house)
	" 25th.	M.	" 46	Mrs R's husband.
	" 25th.	F.	" 6	Daughter.
	" 25th.	F.	" 12	Living in house.
	" 28th.	M.	" -	Servant.
1903	Oct. 28th.	M.	" 18	"

CASES 20 and 21. Mr. R. Farm Servant and his Wife.

These two carriers were found in 1919 in connection with an outbreak at a farm where four cases occurred and where the man was a farm servant. He and his wife had passed through an illness two years before which was almost certainly Typhoid though not diagnosed as such at the time. Both were found to be faecal carriers.

CASE 22. Mrs B. aet.70. Widow, living with two grandchildren in the village of C.

In 1918-1919, the following outbreak of Typhoid occurred in the village:-

1918	Sept. 27th.	Female	aet. 44
	Nov. 13th.	"	" 13
	" 16th	"	" 5
	" 22nd	"	" 2
1919	Jan. 3rd	"	" 8
	" 17th	"	" 9
	" 18th	"	" 6

The source of this outbreak was for a time very difficult to determine. No connection through milk could be found between the cases. Samples were obtained from all the milkers involved in the different supplies, but they proved negative. Later, information was given to me by the mother of two of the cases that the two grand-children of Mrs B who lived close to her had had prolonged illnesses in August and September of 1918 which were unattended by a doctor. I found on enquiry that the symptoms in these cases pointed to Typhoid, and this was fully confirmed by the examination of samples of blood from each of the two children, the blood giving a strongly positive Widal reaction. They had really been the first cases in the outbreak, and the other cases were fairly readily linked up with them. The grandmother had had a very severe attack of Typhoid seven years before while living in a neighbouring town as also had her husband and three of the family, one of the family dying. Mrs B readily agreed to give me samples of stools and urine and the examination of these proved her to be a faecal carrier. She had only come to the village of C six months before, having lived from the time of her attack up to that date in the town above mentioned, but she had not been associated there with any outbreak of Typhoid.

I may add that nearly all the children in the village and some of the adults, about 85 in all, were inoculated as a preventive measure before I discovered that Mrs B was a carrier and the probable source of the outbreak.

Mrs/

Mrs B has since died.

It may be worth recording here the facts regarding two farms in the County at which occurrence of outbreaks over a long series of years pointed clearly to the presence of carriers. One of these was the Farm of B in the A District, occupied by Mr. R. Here for thirty years, prior to 1894, outbreaks of Typhoid had occurred so frequently that in the district the illness came to be known as the "B" Fever. As most frequently happens in such cases, it was the new servants who went there that took the disease. Many of them going home carried the infection to other members of their families. The number of cases of Typhoid directly or indirectly connected with B was put in the district as high as 50 - -60. The last case occurred in February of 1893, a servant girl, 15 years of age. A new water supply had been introduced at the Farm a number of years before and the drainage entirely renewed, but this had had no effect upon the incidence.

In 1894, Mr. R's son succeeded to the Farm. No case occurred after Mr. and Mrs R left. I learned recently that Mrs R had an attack of Typhoid Fever when she was a girl, and at that time there was a serious outbreak at her father's Farm. All the circumstances point to her being the carrier.

The other case to which I would refer was the Farm of S in the D District. From 1896 to 1906, there had been recurring outbreaks at this Farm, as the following Table will/

will show:-

1896	Oct. 1st.	Farm Servant	aet. 28 years.
	" "	" "	" 16 "
	" "	Domestic Servant	-
	" 7th.	Farm Servant	" 16 "
	" "	" "	" 21 "
1897	Sept. 9th.	" "	" 19 "
1900	Aug. 6th.	" "	" 18 "
	Oct. 22nd.	" "	" 17 "
	" 30th.	Boy in cottar house	" 6 "
1901	Feb. 25th.	Farm Servant	" 22 "
	Aug. 28th.	" "	-
1906	June 3rd.	" "	" 24 "
	Aug. 17th.	Domestic Servant	" 25 "
(This case is carrier No. 4).			
	" 25th.	Farm Servant	-

The carrier at S was most probably the housekeeper, Miss G. Mr. P, the tenant of the Farm, was unmarried. The Farm of S was not the only place where Miss G was associated with Typhoid. Cases of Enteric had occurred at the Farm of L which Mr. P had occupied before going to S, and where also Miss G acted as his housekeeper. After Mr. P's death, Miss G left S and went to reside at C. There in 1910, Enteric Fever broke out in a family living near by. One of the children of this family, $3\frac{1}{2}$ years old, who was in the way of going into Miss G's house and getting food from/

from her, developed Typhoid and was notified on October 27th. Two more cases occurred in the house from which the first case, which had not been removed to Hospital, was notified, and were reported on November 29th and December 8th. On this occasion I obtained a sample of Miss G's stools and urine, but they proved negative and further samples were refused. One negative result is, of course, inconclusive. Miss G died some time later, but no cases were associated with her subsequent to 1910, and no further cases have arisen among those closely associated with her during her life.

TREATMENT OF CHRONIC TYPHOID CARRIER

WITH

DETOXICATED VACCINE.

The carrier treated was Case 6 in the list, (page 26). As the details there given show, Mrs M has been a faecal carrier for nineteen years and was the cause of five outbreaks of Typhoid. Before the treatment was commenced, examinations of her stools and urine were made to determine if she were still a carrier. Samples of stools and urine were examined on April 5th and of stools alone on April 15th, May 6th, May 24th, June 30th and July 21st. The first five samples of stools and the sample of urine examined on April 5th were negative, but the sample of stools examined on July 21st was positive. After some delay, treatment was begun in December, the dosage being as follows:-

1,000	millions
2,000	"
4,000	"
6,000	"
8,000	"
10,000	"
12,000	"

rising from this point by additions of 1,000 millions each time to 30,000 millions.

The vaccine was given by subcutaneous injections at intervals of five days, and the following is a note of the reactions observed:- For the first three injections there were no local reactions, but every time after that there was some/

some local reaction in the nature of an inflammatory area round the place of puncture. This however, did not increase in proportion to the increase of dose. Sometimes it was more pronounced, and the next time not so much. It lasted about two days and then gradually disappeared. The arm was changed every time, and the injection was given in the upper arm, but the point of injection was generally about the same. There was no constitutional reaction of any kind until the last few doses when general symptoms of headache, sleeplessness, and very severe backache appeared, while the local reaction got so severe that the arm had scarcely returned to its normal condition when the ten days were up. The treatment was accordingly discontinued for a time.

A sample of stools was examined in the end of March and found to be positive. Another sample taken on the 9th of June, just after the treatment was stopped, resulted in the finding of an organism giving all the cultural reactions of bacillus typhosus, but not agglutinating with serum. A second sample taken on the 16th June and a third on the 15th of July both gave the same organism.

Treatment by subcutaneous injections was resumed in the beginning of September, the same course being repeated, beginning with a thousand millions. At the same time a course of vaccine by oral administration was commenced, and along with the vaccine were given pills of/

of ox-bile; 2 gr. in each. The dosage for oral administration began with 5 minims per day, and was gradually increased to 2 drachms. This was done at Dr. Thomson's suggestion. The second course of subcutaneous injections was continued from the beginning of September till the middle of November, the dose reaching 23,000 millions. The subcutaneous injections were then stopped, but the oral administration of vaccine was continued.

A sample of stools was examined on the 7th of September and proved entirely negative. The non-agglutinating bacillus was not found in it. Since then 17 samples have been examined: 2 in September, 4 each in October, November and December, and 3 in January of this year, and all have been negative. The examination of samples is being steadily continued, in case the absence of typhoid bacilli in the stools is due to an intermittent period, such apparently as she had from April to July, 1921.

Dr. J.W. Tocher reported on the examination of the stools. The first report (test of March 21st, 1922) gave the typical typhoid bacillus; the subsequent reports (tests of June 9th and 29th, and July 21st) gave as a positive result an atypical bacillus giving all the cultural reactions of *B. typhosus*, but not agglutinating with serum. These three were returned as positive. Eighteen other tests, all negative, were made between September 6th, 1922 and January 26th, 1923. The bacillus isolated/

isolated in the three tests immediately following the first test was a Gram-negative rod, feebly motile and giving all the sugar reactions of *B. typhosus*. It was, however, non-agglutinable by any of the stock serums in the laboratory. Emulsions of this culture, injected intravenously into a rabbit, failed to produce agglutinins towards this organism. The growth in broth was inclined to form filaments.

An examination of the organism found in the June and July samples was made in another laboratory to which Dr. Thomson sent a sub-culture, and the report made confirms Dr. Tocher's results. The report is as follows:-

"I do not think it is a typical typhoid bacillus (although I agree it gives all the typhoid sugar reactions, etc.). It is very feebly motile, and has a tendency to become filamentous in broth. We plated it again and it appears pure. Now a guinea-pig has been inoculated with it to obtain immune serum to try against all the typhoid-enteritidis group from the Standards Laboratory, Oxford"

A further report says:-

"An emulsion of that bacillus is not agglutinated by any of the Standards sera *typhosus*, para. A and B, Gaertner and Aertrycke, and so far is not agglutinated by inoculated animal serum. Inoculation with 2 c.cm. of a 24 hours' old broth culture failed to kill a guinea-pig, so that the organism is evidently non-virulent!/"


non-virulent."

Perhaps the most interesting feature in the case recorded is the bacteriological findings in that typical typhoid bacilli were first isolated, and later the organism became atypical, giving the sugar reactions, but failing to agglutinate. Neither B. typhosus nor the atypical bacillus has been recovered from the stools after 18 successive examinations.

TREATMENT OF THREE CHRONIC NASAL DIPHTHERIA CARRIERS
WITH DETOXICATED VACCINE.

While investigating an outbreak of Diphtheria in 1918 and another in 1919, I discovered as the apparent causes of these outbreaks two chronic nasal Diphtheria carriers, one an ex-soldier, G.S. who had his nose carried off in the War by a bullet and was having operations to restore it, and the other a woman, Mrs H. who had had an attack of Diphtheria over a year before while engaged at the Munition Factory at Gretna. A third chronic nasal carrier, M.B. a girl of 12, daughter of a farm servant at R. Banffshire, had come into the County in 1918 to stay with her grandmother in the District of H. She had been identified as a carrier by Dr. Ledingham, Medical Officer of Health for Banffshire, and had been connected with three outbreaks. These three carriers were treated successfully in 1920 with detoxicated vaccine prepared by Dr. D. Thomson. The treatment was carried out by Dr. A.R. Fraser at Summerfield Hospital, which, by the courtesy of the Aberdeen District Committee, was placed at our disposal for the purpose, though none of the carriers belonged to the Aberdeen District.

The treatment of nasal Diphtheria carriers has hitherto not been attended with success. "Military Surgeons" says Professor Simon of Baltimore, "have found that the nasal carriers are the most difficult to treat and that in many of them/



them showing atrophic rhinitis and infected sinuses a cure can hardly be looked for! All the three carriers treated had an unhealthy condition of the nasal mucous membrane. Mrs H had had a polypus removed from her nose in March of 1919, and suffered from chronic rhinitis. The girl, M.B. had a characteristic saddle nose without septum and a very unhealthy naso-pharynx, while the soldier, G.S. had naturally an unhealthy mucous membrane.

The following is a note of the cases in the order in which they were treated with the results:-

1. Mrs H. aet. 52, had a severe attack of Diphtheria in September of 1918 for which she was four weeks in Hospital. She came to Aberdeenshire in November of 1919 to stay with relatives, and a month later an outbreak, with three cases, occurred in the family, a child with whom she slept being the first to become ill. On swabbing the contacts, I found her nasal swab positive and further examinations proved her to be a chronic carrier. She was admitted to Summerfield Hospital on the 26th of March 1920, and treatment was commenced on the 9th of April. On the 11th of May, Diphtheria bacilli, though present, were reported to be non-virulent, and she was discharged on the 21st of May. She returned to her relations at the farm with whom she continued to stay for over two years but no case has since occurred there or been associated with her.

2. M.B./

2. M.B., a girl of 12, daughter of a farm servant. She was discovered to be a carrier in March 1917 by Dr. Ledingham. She had been connected with three outbreaks of Diphtheria in Banffshire in which three deaths occurred. During 1918 and 1919, she was for four periods of two months each in Hospital, and again for two months in the beginning of 1920, but without result. Her father had meantime removed to Aberdeen-shire, but as there was no accommodation for isolation in her home there being a family of young children she continued to live with her grandmother. On the 24th of April 1920, she was admitted to Summerfield Hospital and treatment with detoxicated vaccine was commenced by Dr. Fraser on the 29th of April. By the middle of June, the brushings from the nose had become negative, and she was discharged on June 26th. She went to her father's house at E in the Alford District. Brushings were again taken on the 5th of August, and, as these were negative, she was allowed to go to school. Further brushings taken on the 27th of August proved positive. She was at once removed from school, and, as the Diphtheria bacilli were reported to be virulent, I took her back to Summerfield Hospital on the 14th of September for further treatment. A second course was begun on the 15th of September and completed on the 29th, the doses of vaccine being enormously increased, but without causing any untoward reaction. On the 25th of October, bacilli, though present, were reported to be non-virulent. She was accordingly/

accordingly discharged on the 29th of October and again went back to her home at E. With the consent of the Education Authority and the approval of the Scottish Board of Health to whom I submitted the facts, she returned to school. With the exception of the fortnight in August, she had not attended school for four years.

No case of Diphtheria occurred in this school (K) or in another which she subsequently attended in another district or in her own family where there were five children younger than herself, all susceptible.

I may add that before she was admitted to Summerfield Hospital, I had applied to the Alford District Committee for an allowance of 10/- a week for her maintenance as her grandmother had become unable to keep her without help which her father could not afford to give.

An older sister of M.B. was also a chronic Diphtheria carrier and the cause of two outbreaks - one in a private school in Aberdeen, and the other in a family in Banffshire where she had gone as a servant. After this second outbreak, she lived with her grandmother and her sister in practical isolation till 1919, when she died of Influenza complicated with Septic Pneumonia.

3. A soldier, G.S., 26 years of age. This man was wounded in the face in the War in August of 1915, his nose/

nose having been completely blown off by a bullet. Several operations had been performed with a view of restoring it and he was a patient in Queen's Hospital, Sidcup, when he came home on leave to a farm in the County in August of 1918. During his stay an outbreak of Diphtheria occurred. On taking swabs from the occupants of the house, I found the swab from his nose positive. The bacilli persisted in spite of local treatment and animal inoculation proved them to be virulent. The Medical Authorities at Sidcup refused to take him back for further operation till he was clear. In 1918, he was admitted to the City Hospital, Aberdeen, for two months at the expense of the Pensions Committee and again for the same period in the beginning of 1920, but without result. A course of detoxicated vaccine was commenced on the 12th of July by Dr. Fraser and completed on the 7th of September when the bacilli were reported to be non-virulent. He attended every fourth day for treatment, coming in twenty miles and returning home the same day without experiencing the slightest reaction or trace of discomfort, either generally or locally.

The dosage in the first of the three cases commenced with 200 millions given subcutaneously and rose by doubling up to 3,600 millions; then the same course was given intravenously, eleven injections in all. In the second case, the first course consisted of eleven injections given subcutaneously commencing with 100 millions/

millions and rising to 32,000 millions, while the second course began with 40,000 millions and rose to 250,000 millions, the dose being doubled each time. In the third case, the treatment began with 4,000 millions and rose to 350,000 millions in 12 doses given intravenously.

POSITION OF THE LAW IN SCOTLAND IN REGARD TO TYPHOID CARRIERS.

Up to 1919, there was no legal recognition of a carrier. In the Public Health (Pneumonia, Dysentery, etc.), Regulations issued in that year, carriers of Dysentery were recognised and certain powers granted in regard to "such as were concerned with the preparation or handling of food or drink for human consumption". By Article 14 of the Regulations, these powers were extended to embrace Typhoid carriers. "The responsible manager of the trade or business is to afford the medical officer of health all reasonable assistance in getting a clinical examination of such person carried out". It does not say what is to be done if the person suspected refused to give the samples of stools and urine necessary to prove whether they are carriers or not. There seems no power to compel them to do so though a suspicion or a reason to believe that a person was a carrier would probably be sufficient to exclude him or her from the work of handling food.

By the Public Health (Infectious Disease Carriers) Regulations, issued in 1921, a Local Authority is given for three months the same powers over a carrier as are given by the Public Health Act over persons suffering from the disease. For the purposes of the Regulations, a person has to be certified as a carrier by the medical officer of health and one registered medical practitioner, and to be "a danger to others by reason of the probability of his spreading infectious/

infectious disease!" The certificate is to extend to three months, a further certificate to be granted on a re-examination. At any time during the currency of the certificate, the carrier can demand to be re-examined on giving to the medical officer of health of the area not less than forty-eight hours previous notice in writing, and if as a result of any such re-examination the person is not certified as aforesaid, the Regulations shall cease to apply to and as respects him!"

Two points do not seem to be adequately recognised by these Regulations, first, that, with few if any exceptions, a chronic Typhoid carrier remains a carrier for life, and second, that owing to the intermittency of the discharge of Typhoid bacilli in the stools, negative results would constantly be obtained and carriers cleared while they still remained dangerous foci of infection. They would not readily thereafter give further samples of stools or urine. Further, there is no power given for an examination of those who are not concerned with the preparation or handling of food or drink for human consumption.

I am strongly of opinion that power should be given to obtain samples of stools and urine compulsorily where these are refused and where the evidence is such as would justify a warrant being granted. Removal to Hospital for a limited time might be required so as to ensure a proper examination. Refusal to grant samples has more than once interfered with the complete investigation/

investigation of important epidemics, such for example as that in Aberdeen in 1912. Certain facts that came subsequently to light added probability to the source of this epidemic being infection of milk from a carrier. I discovered some years after that the woman suspected of being the carrier in 1912 was, in 1892, associated with an outbreak of Typhoid - six cases in four families - in a small village to which at that time she supplied milk. Only one sample of stools and urine was obtained from her in 1912, and further samples were refused. The sample was negative, but one negative result is, of course, inconclusive. Dr. Hay, in his Report upon the epidemic says that he had a personal interview with the Medical Member of the Local Government Board as to whether the Law gave power to obtain such samples compulsorily. The latter was inclined to think that the Public Health Act did give the necessary power, but admitted that, although cases presenting a similar difficulty had previously arisen, the Board had as yet not seen its way to advise the adoption of compulsory measures. Dr. Hay adds, "it is doubtful if there is legal power to compel such examination"

I frequently have been refused samples where the evidence pointing to a certain person being a carrier and the cause of an outbreak seemed very strong. Such refusal of samples is not likely to grow less as powers over/

over carriers are increased.

If as the result of a clinical examination a person is certified to be a carrier and his or her living is interfered with, compensation should be given for any loss incurred thereby, and proper provision should be made, if required, for their maintenance. This expense should not devolve on Local Authorities but should be borne partly or mainly by the State. One reason that may be noted in passing is that carriers are more likely to be identified in rural areas and too much of the burden would fall upon such areas, while the discovery and control of carriers is equally important for the towns in view of the danger of milk epidemics. The whole question is one that should be dealt with on the most comprehensive lines.

CONCLUSIONS.

The following conclusions seem to be warranted by the facts contained in the foregoing Paper:-

1. That the chief source of Typhoid Fever and the sole cause of its remaining endemic in a rural area is the presence of carriers in that area.
2. That almost all these carriers are faecal.
3. That when the carrier condition becomes chronic, recovery seldom, if ever, takes place.
4. That treatment of Typhoid carriers with detoxicated vaccine seems to offer some prospect of success.
5. That treatment with detoxicated vaccine in the case of three chronic nasal Diphtheria carriers proved definitely successful.
6. That the Law dealing with Typhoid carriers seems to require alteration in certain directions.
7. That proper provision should be made for the maintenance of chronic Typhoid carriers where their means of living has been interfered with and who are not able to maintain themselves, and that this should be done mainly by the State.

If/

If vaccine treatment should prove a means of cure for Typhoid carriers, this burden would be removed, and the Law dealing with carriers could be strengthened without inflicting upon them too great hardship.

In conclusion, I take leave to say that the more my experience of administrative work in a rural County has been, the more am I convinced that rural areas offer opportunities for the elucidation of epidemiological problems such as can not be got in crowded cities, and this holds more particularly in the case of Typhoid Fever and Diphtheria.

The problem of the cure of carriers is perhaps the most important of all Public Health problems of the present time. As the Lancet puts it in a Leader of November 13th, 1920:- "The "carrier" problem in infectious disease is one of the most difficult, and at the same time, one of the most urgent questions from the point of view of the hygienist, the bacteriologist, and the medical practitioner. It is incidentally one of great interest to the Public, although it may be doubted whether that interest has yet been sufficiently aroused. Nor is the time quite ripe for insisting upon public education, since it must be confessed that efficient methods of discovering the carriers and of rendering them innocuous have yet to be evolved!"

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